09/868969
JC18 Rec'd PCT/PTO 22 JUN 2001

1998P08652WO
PCT/DE 99/03947

Description

Semi-submersible deadweight cargo vessel

The invention relates to a semi-submersible deadweight cargo vessel. Such cargo vessels are used principally for transporting large and heavy bulk materials and are distinguished by a tonnage of far more than 10,000 t. In contrast to conventional cargo vessels in which the cargo is loaded and unloaded with cranes, and which are therefore subject to limits in terms of the dimensions of the freight to be transported, semi-submersible deadweight cargo vessels are particularly suitable for transporting bulky items, for example complete oil drilling platforms, port crane systems or medium-sized to large water vessels or parts thereof. For this purpose, according to the invention, semi-submersible deadweight cargo vessels are composed of a front part in which the drive system and the command and crew rooms are located, and a rear part which is essentially embodied as a hollow-walled float which has ballast tanks and a planar transport platform.

By flooding the ballast tanks it is possible to submerge the semi-submersible deadweight cargo vessel to such an extent that the transport platform sinks below the water line so that floatable cargo, or cargo which is loaded on a pontoon for example, can be placed on it or removed from it. Conversely, by freeing the ballast tanks it is possible to raise the transport platform under the cargo to be transported in order to load on said cargo. In addition to this float-on/float-off method, cargo can also simply be loaded and unloaded with what is referred to as the roll-on/roll-off method by raising or lowering the transport platform of the semi-submersible deadweight cargo vessel to the level of the quay.

It is known to provide cargo vessels with an electric vessel's drive. In diesel-electric systems, the electric propeller motor is usually supplied by generators which are driven by diesel engines and/or gas turbines. A diesel-electric drive requires higher investment costs in comparison with diesel engines which are coupled directly to the vessel's propeller, but it provides the advantage or more efficient use and makes possible a high torque on the propeller shaft, even under very large load conditions. In addition, with diesel-electric drives there is no risk of inadequate machine control if the propeller leaves the water, for example in rough seas.

In conventional diesel-electric drives, all the electric parts of the system are accommodated inside the vessel, and engines, gear mechanisms and drive shafts are aligned flush with one another. Other unsatisfactory aspects of this are the occurrence of high mechanical and hydrodynamic losses and restricted maneuverability in comparison with propellers which are driven from outside the vessel. A comparatively uneconomical consumption of fuel is also disadvantageous.

The periodical Schiff & Hafen, issue 11/1979, discloses a semi-submersible vessel in the article "Condock I" for carrying lighters or floating containers, which vessel is designed with floatable and freeable bottom and side tanks for loading and unloading cargo in accordance with the float-on/float-off and/or roll-on/roll-off method, and has, as main machine, a diesel engine in the rear part of the vessel. In order to improve the maneuverability, a transverse thrust device is provided in the forebody.

The object of the invention is to disclose a semi-submersible vessel which can keep its position without the aid of tugs or anchors and which has a large, planar loading platform suitable for carrying bulky goods.

The object is achieved in that the diesel engines are part of a diesel-electric drive system, the diesel-electric drive system being arranged in the forebody and supplying power to at least one electric azimuth rudder propeller arranged under the stern, the loading area being embodied as a planar transport platform and the azimuth rudder propellers permitting, together with the transverse thrust device, precise position control during lowering, even when there is a considerable wind force.

It is advantageous to arrange the diesel-electric drive system in the forebody so that optimum utilization is made of the space available on the vessel with respect to the transportation suitability of the deadweight cargo vessel. An arrangement of the essential pieces of equipment in the forebody ensures maximum possible variability for loading and unloading cargo onto and off the transport platform in the afterbody, which is not subject to any structural restrictions in this way.

It is also advantageous to drive the azimuth rudder propeller by means of an electric motor which is arranged outside the vessel and which is fed by at least one generator driven by the main machines. The use of electric motors which are arranged outside the vessel for driving one or more azimuth rudder propellers provides the advantage of particularly good maneuvrability. This drive technology which is known in practice under the designation SSP is distinguished in this case by a low level of vessel resistance with a very wide variety of vessel bodies and does not require any additional cooling because the water flowing around the electric motor has a cooling effect. Furthermore, the SSP drive is associated with low use and maintenance costs.

Azimuthing rudder propellers are already known, for example as in the brochure from ABB "Azimuthing Electric Propulsion Drive" but this drive for the types of vessel specified in this brochure

was not selected according to the criteria of the design of the loading area and the self-positioning of the vessels equipped with it.

According to a further feature of the invention, the azimuth rudder propeller is embodied as an azimuthing rudder double propeller. Double propellers are associated with higher procurement and maintenance costs in comparison with single screws, but providing two propellers makes it possible to have a smaller propeller diameter, enabling the semi-submersible deadweight cargo vessel to be constructed with a smaller draft, which reduces costs. According to one advantageous development of the invention, the transverse thrust device is also driven electrically, contributing to making the design of the deadweight cargo vessel fuel-efficient and cost-effective.

In one preferred embodiment, the transverse thrust device in the forebody can be controlled from a central navigation console in the wheelhouse and from two bridge side wings of the semi-submersible deadweight cargo vessel, in order to ensure maximum visibility when maneuvering. This is also promoted if, according to a further advantageous feature of the invention, the flooding and freeing of the bottom and side tanks can be controlled from a control console on the rear side of the wheelhouse.

The switching and signaling boards of the semi-submersible deadweight cargo vessel are expediently accommodated in a sound-insulated machine control room in order to damp the level of sound emitted by the vessel’s machinery. For this purpose, it is also advantageous to provide, according to a further feature of the invention, the main machines with sound dampers.

In order to make operating costs particularly low, according to one advantageous development of the invention, the diesel

engines can be operated with heavy oil which has a viscosity of approximately 3,500 s Redwood. Low operating costs are also promoted if, according to one further advantageous development of the invention, diesel engines which can be operated with marine diesel oil are provided as auxiliary machines. The auxiliary machines are advantageously installed here on a vibration-damped base so that a minimum possible noise level is generated.

According to one further feature of the invention, the exhaust gas line of the drive system is movably arranged in order to ensure maximum possible variability with respect to operating of lines in a favorable way with respect to sounds.

Further details and advantages of the subject matter of the invention emerge from the following description of a preferred exemplary embodiment. In the associated drawing, in particular:

Fig. 1 shows a side view of a semi-submersible deadweight cargo vessel;

Fig. 2 shows a plan view of the semi-submersible deadweight cargo vessel according to FIG. 1, and

Fig. 3 shows a side view of an azimuth rudder double propeller.

The semi-submersible deadweight cargo vessel illustrated in figures 1 and 2 has an overall length of 156 m. The length between the casting lengths is 145 m. The cargo deck has a length of 126 m, a width of 32.26 m and a free cargo area of approximately 4,065 m^2. The height of the sides in the vicinity of the cargo deck is 10 m, while the draft of the semi-submersible deadweight cargo vessel is 7.50 m with freeboard and 19.0 m with the cargo deck lowered.

The semi-submersible deadweight cargo vessel has a dead weight of 18,000 t with freeboard. This is composed of 2,000 t heavy oil (HFO 380) which serves as fuel for the main machines, 172 t marine diesel oil which is used as fuel for the auxiliary machines and for which a loading capacity of approximately 200 m^3 is present, 300 t fresh water, for which there is a corresponding loading capacity of 300 m^3, 25 t lubricating oil, 20 t supplies for the crew, 20 t spare parts and 15,463 t payload. The average molded draft is approximately 7.5 m with this dead weight in sea water with a specific density of 1,025 t/m^3. This corresponds to the draft with freeboard.

The semi-submersible deadweight cargo vessel also has a loading capacity of approximately 40 m^3 for dirty oil and of approximately 5 m^3 for waste water. Accommodation for 22 crew members and 16 passengers is provided in the forebody, above the foredeck. 3 diesel engines with a rotational speed of approximately 720 min^{-1}, which serve as the main machines, are also arranged on the forebody. With the diesel engines which are embodied as 9-cylinder series-mounted machines it is possible to generate electrical power of approximately 3,645 kW each. With electrical losses of approximately 8.7% of the generator when driving, and without supplying the vessel's electrical system, a power of 8,675 kW can thus be made available.

The semi-submersible deadweight cargo vessel is also equipped with two auxiliary machines, embodied as diesel engines, for generating power for the vessel's electrical system, said machines supplying a generator power of 720 kW each with a rotational speed of 720/900 min^{-1}. A third diesel generator, which has a rotational speed of 1800 min^{-1} and a generator power in accordance with the SOLAS regulations is provided for when the vessel is docked and for emergencies.

Two azimuth rudder double propellers, which are each driven by means of electric motors arranged outside the vessel

and can generate an operating speed of 14 kn are used as the vessel's drive. This drive, which is referred to as an SSP drive (illustrated in fig. 3) is supplemented by two electrically driven transverse thrust devices which improve the maneuverability and stability of the deadweight cargo vessel. Trials have shown that the lowered deadweight cargo vessel can be readily controlled precisely against a wind force of 6 to 7 Beaufort using the two transverse thrust devices.

A multiplicity of winches are provided for fastening the cargo on the cargo deck. Sound protection measures, for example the spatial separation of machine rooms and accommodation, noise-proofing encapsulation of the accommodation on the foredeck or sound damping for the main machines, ensure ergonomic working conditions. The semi-submersible deadweight cargo vessel can be lifted from the lowered draft of 18 m to a draft of 7.50 m within 4 hours by pumping empty the ballast tanks using compressed air. As a result of the low consumption by the main machines of 46.98 mT/24 hr it is possible for the semi-submersible deadweight cargo vessel, which can also be a dock vessel depending on the application, to be at sea for a period of 34.6 days longer, basing the calculation on 360 days, than comparable conventional vessels. This means that additional cargo can be transported for the same operating costs. The high fuel efficiency is also due to the fact that, depending on requirements, just one or two diesel engines of the main machines are operated. Last but not least this also allows for ecological factors.